



ALASKA DEPARTMENT OF FISH AND GAME

*DIVISION OF COMMERCIAL FISHERIES*

MEMORANDUM

TO: Denby S. Lloyd  
Director  
Commercial Fisheries Division  
Headquarters - Juneau

DATE: September 28, 2006

PHONE: (907) 486-1865  
FAX: (907) 486-1819

THRU: Jim McCullough  
Regional Supervisor  
Commercial Fisheries Division  
Region IV - Kodiak

FROM: Douglas Pengilly  
Regional Shellfish Research Supervisor  
Commercial Fisheries Division  
Region IV - Kodiak

SUBJECT: Bering Sea Snow  
Crab TAC  
for 2006/2007

cc: Distribution

This memo summarizes results of a teleconference meeting held at 9 AM on 22 September 2006 to determine the total allowable catch (TAC) for the Bering Sea snow crab fishery in the 2006/2007 season. ADF&G staff attending were Jim McCullough, Wayne Donaldson, David Barnard, Douglas Pengilly, Leslie Watson, Skip Gish, Doug Woodby, Jie Zheng, Shareef Siddeek, Forrest Bowers, and Barbi Failor. NOAA Fisheries staff attending were Lou Rugolo, Jack Turnock, and Gretchen Harrington. Diana Stram (NPFMC) was not available. In preparation for the teleconference, I distributed via email on 15 September 2006 a review document for the Bering Sea snow crab stock. That document reviewed the Federal minimum stock size threshold (MSST), the State harvest strategy, stock assessment methods, fishery and stock history, results of the 2006 NMFS eastern Bering Sea trawl survey, 2006 stock status relative to the federal overfished definition, and a comparison of TAC computations for 2006/2007 based on area-swept estimates and snow-crab-assessment model estimates. That review document (with corrections made to some minor typographical or formatting errors that were brought to my attention after being distributed on 15 September 2006) is attached.

It was concluded during the teleconference, without any objection from meeting participants, that the Bering Sea snow crab fishery will open for the 2006/2007 season with a TAC of 36.566-million pounds (including the portion allocated to the CDQ fishery). The TAC was computed using abundance and biomass estimates produced by the 2006 snow crab assessment model,

which were provided by NOAA Fisheries. Use of estimates produced by the 2006 snow crab assessment model was deemed preferable for establishing the 2006/2007 TAC relative to use of the area-swept estimates provided by NOAA Fisheries. The area-swept estimate of large ( $\geq 4$ -inches CW) legal males had unusually poor precision in 2006, was heavily influenced by the catch in one haul, and was higher than expected from previous survey results.

## Bering Sea Snow Crab

### MSST (Federal Minimum Stock Size Threshold for “overfished” status)

- **FMP definition:** 460.8-million pounds of total mature biomass
  - **2006 total mature biomass estimate:** 500.2-million pounds (NOAA Fisheries 2006 snow crab assessment model “survey” estimate)
- ⇒ **Stock is above MSST, but remains in “overfished” condition**

### State harvest strategy fishery threshold and minimum TAC for fishery opening

- **Fishery threshold definition:** 230.4-million pounds of total mature biomass
- **State minimum TAC:** 16.667-million pounds (including the portion allocated to the CDQ fishery)
- **2006 estimate for total mature biomass:** 500.2-million pounds (NOAA Fisheries 2006 snow crab assessment model “survey” estimate)
  - ⇒ **Stock is above threshold for a fishery opening**
  - ⇒ 14.88% exploitation rate on estimated mature male biomass applies (constrained by 58% maximum harvest rate on exploited legal male abundance)
- **TAC computed according to harvest strategy:** 36.814-million pounds (including portion allocated to CDQ fishery)
- **TAC computed according to harvest strategy and accounting for closure of statistical area 695700 for Pribilof blue king crab protection:** 36.566-million pounds (including portion allocated to CDQ fishery)

### Choice of 2006 snow crab assessment model estimates over area-swept estimates for computing 2006/2007 TAC

This is the first season that abundance and biomass estimates produced by the snow crab assessment model were considered for computing the snow crab TAC. The NPFMC Crab Plan Team had reviewed the 2006 version of the model at their 13-15 September 2006 meeting. The team noted improvements that had been made to the fit of the model. The team noted that significant areas for development and improvement of the model remained, but the team agreed that the model provided more accurate estimates for 2006 snow crab abundance and biomass than the area-swept estimates in 2006. In particular, the 2006 area-swept estimate for the harvested portion of the stock (males  $\geq 4$ -inches CW) had unusually poor precision; NOAA fisheries staff reported the 95% confidence for that estimate were  $\pm 76\%$  of the point estimate. Additionally, NOAA Fisheries staff observed that the 2006 area-swept estimate for males  $\geq 4$ -inches CW had doubled from the 2005 area-swept estimate and noted that result was not expected from previous survey data. Although the model may still require more development and improvement in the future, the 2006 area-swept estimates were considered less reliable.

During the teleconference meeting, TACs computed using the area-swept estimates and the estimates produced by the 2006 snow crab assessment model were compared and discussed. Applying the area-swept estimates to the harvest strategy resulted in a TAC of 52.386-million pounds; applying the assessment model “survey” estimates to the harvest strategy resulted in a

TAC of 36.814-million pounds. Discussion centered on the poor precision associated with the area-swept estimate of abundance for males  $\geq 4$ -inches CW. It was noted that since the 1999 survey (when the stock was declared "overfished" and more conservative harvest strategies came into use), the "plus-or-minus" bounds on the annual area-swept abundance estimates of males  $\geq 4$ -inches CW were typically between  $\pm 20\%$  and  $\pm 30\%$ . It was noted that, in past considerations of fisheries on other Bering Sea crab stocks,  $\pm 76\%$  confidence bounds have been considered too broad to establish a harvest level. Attention was also directed on the influence of a single tow on the area-swept abundance estimate and its precision; one tow alone ([**CONFIDENTIAL DATA – SURVEY CATCH DATA BY LOCATION**]) contributed 50.3-million crabs to the total area-swept abundance estimate of male snow crabs  $\geq 4$ -inches CW for the standard survey area (143.9-million crabs). By contrast, the snow crab assessment model survey estimate of males  $\geq 4$ -inches CW for the entire survey area was only 80.9-million animals (that compares to an area-swept estimate for  $\geq 4$ -inches CW from the 2005 survey of 72.1-million males  $\pm 21\%$ ). Jie Zheng reported during the meeting that he had re-estimated the area-swept estimate for males  $\geq 4$ -inches CW by using the average of the 8 adjacent tows with the tow for station [**CONFIDENTIAL DATA – SURVEY CATCH DATA BY LOCATION**] to obtain a new estimate for the density of males  $\geq 4$ -inches CW in station [**CONFIDENTIAL DATA – SURVEY CATCH DATA BY LOCATION**]; that resulted in an estimate of 92.2-million males  $\geq 4$ -inches CW. That estimate gave greater confidence in use of the model-based estimate (80.9-million males  $\geq 4$ -inches CW) than the area-swept estimate being considered (143.9-million males  $\geq 4$ -inches CW). Additionally, it was noted that, were the area-swept estimate for males  $\geq 4$ -inches CW reduced from 143.9-million crabs to 92.2-million crabs, the computed TAC using the area-swept estimates would be reduced from 52.386-million pounds by at least 14-million pounds. Again, that gave greater confidence in use of the TAC computed from the model-based estimates (36.814-million pounds) than use of the TAC computed by the area-swept estimates (52.386-million pounds). Following this discussion, it was agreed to use the 2006 snow crab assessment model "survey" estimates to compute the TAC according to the harvest strategy.

A value of 25% was used to estimate the old-shell selectivity for the 2006/2007 season and to compute the estimated abundance of exploited legal males. Applying the 25% value for old-shell selectivity results in an estimated exploited legal male abundance of 50.375-million crabs. An average weight of 1.26 pounds for males  $\geq 4$ -inches CW was used to compute the TAC.

To minimize risk of bycatch of any blue king crab during the fishery, it was determined that statistical area 695700 should be closed to fishing. Hence, prior to determining the TAC, the estimated abundance of exploited legal males within statistical area 695700 was subtracted from estimated abundance of exploited legal males; that reduced the TAC from 36.814-million pounds to 36.566-million pounds.

### **Stock status summary**

Regardless of whether the area-swept estimate or the model-based estimate is used, the stock in 2006 is above MSST, but remains below the rebuilt level (921.6-million pounds of total mature biomass). Neither the area-swept estimates nor the model-based estimates provided by NOAA Fisheries indicate a strong trend in rebuilding of total mature biomass. Area-swept estimates of total mature biomass have shown a trend of "hovering about" MSST for the last 8 surveys, whereas the 2006 snow crab assessment model estimates that total mature biomass has been slowly increasing since 2003.

**Distribution:**

ADF&G: Wayne Donaldson, Forrest Bowers, Mary Schwenzfeier, Ryan Burt, Jie Zheng,  
Shareef Siddeek, Doug Woodby, Earl Krygier, Herman Savikko, Ivan Vining, David Barnard,  
Robert Gish, Susie Byersdorfer, Leslie Watson, Jan Rumble  
NOAA Fisheries: Lou Rugolo, Gretchen Harrington, Jack Turnock  
NPFMC: Diana Stram

**Attachment:**

Review for 2006/2007 Bering Sea *bairdi* TACs